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Trading permanent and temporary carbon emissions credits

An editorial comment

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In this issue of Climatic Change, Van Kooten (2009) addresses an issue that has bedeviled negotiators since the drafting stage of the Kyoto Protocol. If we accept that increasing withdrawals of carbon dioxide from the atmosphere has the same net impact on the climate system as reducing emissions of carbon dioxide to the atmosphere, how do we design a system that allows trading of one for the other? As van Kooten expresses the challenge: "The problem is that emissions reduction and carbon sequestration, while opposite sides of the same coin in some sense, are not directly comparable, thereby inhibiting their trade in carbon markets." He explains: "The difficulty centers on the length of time that mitigation strategies withhold CO_2 from entering the atmosphere—the duration problem." While reducing emissions of CO_2 represents an essentially permanent benefit for the atmosphere, capturing CO_2 that has been produced (whether capture is from the atmosphere or directly from, for example, the exhaust from power plants) there is the challenge of storing the carbon and the risk that it will yet escape to the atmosphere. Permanent benefit to the atmosphere is often not assured for carbon sequestration activities. This is especially true if the carbon is taken up and stored in the biosphere—e.g. in forest trees or agricultural soils.

Van Kooten states four basic premises: 1.) biological sink activities undoubtedly help mitigate climate change and should not be neglected; 2.) biological sink activities could obviate the need for reductions in fossil-fuel use; 3.) biological sequestration activities could have high transaction costs related to measurement, monitoring, and accounting; and 4.) biological sequestration is susceptible to marketing of dubious

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credits. For these four premises we might add, respectively: 1.) we agree, 2.) at least in the short term, 3.) probably, and 4.) this is a fact not unique to biological sequestration activities.

As discussed by van Kooten, there have been several ideas pursued for dealing with temporary sequestration of carbon from the atmosphere, none of them yet accepted as being fully satisfactory. Our earlier proposal (Marland et al. 2001; Sedjo and Marland 2003), that when carbon credits are not truly permanent they should be rented rather than traded, is the starting point for van Kooten's discussion. The United Nations Framework Convention on Climate Change has adopted a similar, but more cumbersome, system of temporary credits for the Clean Development Mechanism of the Kyoto Protocol. In the UNFCCC system temporary credits expire or can be renewed, or they can be replaced by further temporary or permanent credits. But the concept of temporary or rented credits has not yet found universal favor and analysts like van Kooten continue to examine the possibilities. In this paper van Kooten concludes, pessimistically we think, that temporary sequestration is unattractive, partly because it is temporary but largely because of high transaction costs and the risk of activities of dubious merit.

Van Kooten presents some simple, yet elegant, mathematical arguments to demonstrate that credits for biological sequestration should not be traded one-for-one with credits for reduced fossil-fuel emissions or credits from other sequestration activities. The mathematics leads to 5 simple propositions that we can summarize as follows:

1.) Short term projects are worth less than long term projects—regardless of whether they are based on sequestration or emissions reduction.
2.) Simple proportionality does not hold. Doubling the lifetime of a short term project does more good than doubling the lifetime of a long term project.
3.) The relative value of short term projects goes up as the discount rate goes up.
4.) The relative value of short term projects goes down as the shadow price of emissions credits goes up.
5.) What really matters is the lifetime of the project, not the form it takes. That is, the values of sequestration and emissions reductions are the same if their lifetimes are the same.

The primary argument in these propositions is that emissions reductions have inherently greater value than biological sequestration because they have inherently longer lifetimes, i.e. they withhold CO_2 from the atmosphere with longer duration. Van Kooten's propositions are generally phrased as a comparison between emissions reductions and biological sequestration but they are fundamentally about the duration of limiting emissions to the atmosphere.

We tend to agree with van Kooten's propositions, and with his stated concerns about sequestration activities, but not necessarily with the conclusions he draws from them. Surely temporary credits are less valuable than permanent credits under most circumstances, and surely all types of mitigation projects raise concern about dubious activities and project leakage. And yet many of us tend to live in rented apartments rather than in purchased homes and many of us drive leased or rental cars under some circumstances. The challenge is not to discourage activities where permanence is not assured but to design a system that assures their value and

minimizes transaction costs. Van Kooten offers some ideas in this direction but paints a pessimistic outlook.

The reasons for renting rather than owning places to store carbon are probably not so different from the reasons for renting a place to live or a place to park a car. They have to do with, for examples, risk, capital, discount rate, and time. Marland et al. (2001) elaborated 8 potential benefits of renting carbon credits:

1.) It postpones or slows the rate of climate change
2.) It buys time for technological progress
3.) It buys time for capital turnover
4.) It may save money for reasons not already listed
5.) It allows time for learning to occur
6.) It may not be possible to arrange for formal insurance in perpetuity
7.) Project hosts may be reluctant or unwilling to provide guarantees in perpetuity
8.) Some temporary sequestration may turn out to be permanent.

Dornburg and Marland (2008) have noted that even temporary sequestration activities, if implemented soon, put us on a lower emissions path and hence create or preserve options for the long term that would otherwise not be available. We raise two further matters here, the additional benefits of carbon sequestration activities and the efficiency of scale. Many biological carbon sequestration activities support benefits beyond carbon sequestration, non-market benefits like protection of biodiversity and protection of watersheds. The motivation of mitigating climate change may often bring a variety of added benefits that are difficult to value. (We note that van Kooten does not address the fact (nor do we here) that biological sequestration activities have impacts on the climate system beyond their carbon balance—e.g. through the impact of biological systems on the Earth surface energy balance via effects on albedo and latent heat transfer.) Also, if multiple parties pay a third party to manage carbon sequestration (or emissions reduction) activities, that single party may be able to better manage the transaction costs that concern van Kooten. And, as pointed out by Marland et al. (2001) although an individual project may not be permanent, the aggregate of sequestration activities is likely to provide more carbon sequestration than would exist in their absence. As long as the aggregate carbon input to biological sequestration activities exceeds the aggregate carbon outflow, the overall program really is permanent—and growing.

Van Kooten points out that for trading of credits from sequestration activities there needs to be full system accounting and proper accounting of risk. In the current era, where emissions mitigation activities are still often about corporate image or personal conscience, many ‘feel-good’ projects probably yield some real environmental benefit. But we agree that when obligations tighten and the dollars are real, accounting needs to take on a real vigor. Van Kooten suggests that an acceptable accounting system should have two characteristics. First, credits and debits should be symmetric and immediate. Emissions to the atmosphere should produce debits and withdrawals from the atmosphere should produce credits, and (in order to accommodate protection of existing forests) measurement should be against an agreed baseline. Second, transaction costs would be reduced if we monitored the implementation of sequestration activities rather than their carbon stocks or flows. We agree that both of these are good ideas—see West et al. (2004) for

extended discussion of monitoring sequestration activities rather than measuring carbon stocks or flows.

Van Kooten suggests that non-permanent activities are difficult to compare with permanent ones. As we elaborated earlier (Marland et al. 2001; Sedjo and Marland 2003), we believe that permanent and temporary sequestration are tradable and can interact in markets. A market for renting emissions offsets would complement the market for buying and selling permanent emissions credits and is capable of establishing transaction values. The value of emissions offsets would vary with their duration, their uncertainty, their risk, the buyer's (renter's) discount rate, and with the buyer's (renter's) expectation of the growth rate of damages from carbon emissions. Whether biological sequestration activities are financially competitive with other CO_2 reduction activities (van Kooten suggests they often are not because of high transaction costs and high uncertainty) is an altogether different question—a question for functioning markets. We suggest that there is real value in carbon sequestration that is not demonstrably permanent, and that there should be a simple infrastructure to deal with "temporary" sequestration for those occasions when it provides value to interested traders.

While we find much to agree with in van Kooten's paper we are not persuaded that there are important "limits to the substitutability between temporary offset credits from these (biological sink) activities and emissions reductions". Surely "great care must be taken, and appropriate institutions put in place, before terrestrial ecosystem sink activities can be included in a carbon trading system", but we believe that carbon sequestration in biological activities, such as protection of global forests, can be an important activity and not "a distraction from the actual job of mitigating climate change"—an assertion that van Kooten offers as "our main conclusion". Careful accounting and functioning markets should be able to provide mitigation benefits (and ancillary values) from biological carbon sequestration activities, even where permanence cannot be guaranteed.

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